and establishing economic theory. But at the same time he exposes the utter inadequacy of a merely inductive method to deal with the complex phenomena of industry and commerce. He quotes approvingly Bagehot: "If you attempt to solve such problems without some apparatus of method, you are as sure to fail as if you try to take a modern military fortress—a Metz or a Belfort—by common assault." Addressing extreme representatives of the exclusively historical school, Mr. Keynes condemns them out of their own mouth. Owing to that shifting character of economic conditions upon which they are always insisting, the study of the past becomes less applicable to the problems of the present day.

One difficulty in forming a judgment about the pretensions of the historical school is to know what they mean to assert beyond what every sensible person admits. "It is far from being easy," says Mr. Keynes, "to gain a clear idea of the form to be assumed by economics when its 'transformation' has been effected." His gentle reproof may be contrasted with the slashing sarcasm of a recent writer who applies to the historical school what has been said of the French, "that they don't know what they want, and will never be satisfied till they get it." Mr. Keynes, it must be admitted, is less incisive and epigrammatic than some preceding writers upon method. He is less entertaining to those who already agree with him; but perhaps he is more likely to convert those who differ from him.

The parallel which we have attempted to draw between the present and the earlier work of the author would not be complete if we did not point out that he has done more than merely consolidate the *dicta* of the earlier authorities. He has not only gone over the beaten road, mending it in places; but also, diverging into a comparatively fresh field, he has struck out a new path, or rather converted what was but a path into a highway. We allude to his remarkable chapter on symbolical and diagrammatic methods in political economy. Following upon Prof. Marshall's great work, in which these methods are so potently employed, Mr. Keynes's careful statement of their uses is likely to obtain general acceptance. Most of the previous writers who had taken much the same general view as to the functions of deductive reasoning had not considered that particular species of deduction which is effected through the channel of mathematical conceptions. Some eminent theorists were perhaps silent on this head from motives of discretion, knowing the hardness of readers' hearts. With others the cause may have been that which Dr. Johnson assigned for one of the mistakes in his dictionary, "Ignorance, madam, pure ignorance." Jevons, indeed, is a conspicuous exception. But his very zeal marred his advocacy. His personal connection with the cause impaired his authority. A plain man could hardly feel certain but that the new calculus was not a plaything like the "logical machine." Accordingly, when in the course of an impartial summing up of the claims of different schools, Mr. Keynes is far from condemning the mathematical method as trivial, his judicial utterances are likely to have a considerable effect. Very convincingly he dwells upon the appropriateness of mathematical symbols to represent the mutual dependence of variables and other leading conceptions of political economy. The peculiar genius of the economical calculus is thus seized:—

> "Functions, while remaining numerically unknown, may possess known properties; and on the assumption that certain general relations between quantities hold good, it may be possible mathematically to deduce further relations that could otherwise hardly have been determined."

Altogether, it is a matter for rejoicing that the task of connecting and supplementing all the authorities on all the methods has devolved upon one so widely read, so impartial and exact. On a subject which it is undesirable to be always reopening, it may be hoped that Mr. Keynes's work will prove final. It may be expected that his second logical treatise will enjoy the same popularity as his first; for it deserves the same rare encomium—that, if a reader is under the necessity of confining himself to a single book upon the subject, the single book had best be that of Mr. Keynes. F. Y. E.

OUR BOOK SHELF.

Mixed Metals, or Metallic Alloys. By A. H. Hiorns (London: Macmillan and Co., 1890.)

THIS is a useful little book, which will render good service to the craftsmen for whom it is evidently intended, and by whom such a work was much needed, for, with the exception of the translation of Guettier's "Guide Pratique des Alliages" and Brannt's "Metallic Alloys," there is no treatise on the subject, the information we possess being scattered through books and monographs which are difficult to obtain.

Mr. Hiorns begins with a reference to Gellert's "Metallurgic Chemistry," but he can hardly be familiar with even the English edition of Gellert's work published in 1776; he would have refrained from adopting the title of "Mixed Metals" for his book if he had had Gellert's clear indications as to the solvent action of metals on each other to guide him, supported as they are by Matthiessen's later experimental evidence, which led him to define alloys as "solidified solutions." It is true that in many cases, when masses of fluid alloys solidify, certain groups of constituents "fall out" of solution, but there is no known instance of a pure metal separating from the mass with which it was united, and remaining simply mixed. It is to be regretted that, for the sake of employing a term well known in the "metal trades," artisans should have an erroneous suggestion as to the nature of alloys conveyed by the very title of a hand-book.

In dealing with the effects of elements on metals, the indications are not quite as definite as could be wished. For instance, it is stated that "much arsenic is highly injurious" to copper, "making the metal hard and brittle"; but what should be considered *much* arsenic in a case of this kind? If certain metals were melted with gold, the ten-thousandth part of the added matter would impair the ductility of the gold, and would render it impossible for the jeweller to use it; but as regards the case in point—the action of arsenic on copper—a "trace" of arsenic would greatly diminish the value of the copper for electrical purposes, nevertheless the presence of as much as 1 per cent. would not be injurious if the copper had to be used for the fire-boxes of locomotives.

The author contributes the results of some important experiments of his own in connection with the manufacture and use of alloys of copper, nickel, and zinc, known as German silver. The sections which relate to alloys of iron with other metals are well done, as are those in which phosphor-bronze is dealt with. What is needed

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throughout the volume is fuller reference to authority, and graphic illustrations of the properties of alloys by means of curves. The author may, however, be said to have fully justified his claim to have offered practical men and students a book which will enable them to gain "a more intimate acquaintance with the nature and properties of metals in the alloyed state" than they have hitherto had for ready reference. W. C. ROBERTS-AUSTEN.

Grasses of the South-West: Plates and Descriptions of the Grasses of the Desert Region of Western Texas, New Mexico, and Southern California. Part I. By Dr. Geo. Vasey. Published by Authority of the Secretary of Agriculture. (Washington: Government Publishing Office, 1890.)

THIS work is issued by the United States Department of Agriculture, and is the twelfth Bulletin relating to botany which has been published by the Department. In this first part fifty uncoloured figures of the characteristic grasses of the south-west are given. The drawings are made by Mr. William Scholl, and the botanical determinations and descriptions are furnished by the veteran chief botanist of the Department, Dr. Geo. Vasey. The region of country immediately adjoining the northern boundary of Mexico, including the western part of Texas and the greater part of New Mexico, Arizona, and Southern California, is one of great heat and aridity. It is mainly a region of elevated plains, intersected by mountain ranges which occasionally run into high peaks, and is drained by comparatively few streams. In consequence of these climatic conditions the grasses become scanty, not in variety of species, but in individual quantity: some of them being short-lived, springing up rapidly after the summer rains, and soon dying away; others perennial, provided with deeply penetrating roots which enable them to bear the long droughts. Nowhere do the native grasses form a continuous herbage, as in our English meadows and pastures. The common grasses of the Northern and Eastern States are nowhere to be seen. This tract of country is getting more and more settled, and the most important agricultural problem before its inhabitants is how to increase the production of grasses and forage plants on the arid lands. It is very likely that this can best be done by bringing some of the native grasses into cultivation. The present work is issued mainly to give aid in this direction. A second part, containing fifty more plates, is in preparation; and this will be followed by a synopsis of all the grasses which grow wild in the district. Amongst the natives which are specially recommended for trial are *Panicum bulbosum*, *Stenotaphrum americanum*, *Hilaria mutica*, *Andropogon saccharoides*, *Bouteloua aristoides*, and *B. eriopoda*. There is a native species of millet, *Setaria caudata*.

The figures are very characteristic, and accompanied by botanical dissections. A large proportion of the species belong to Chlorideæ, a tribe which is scarcely represented in the European flora; and only two of them to Festuceæ, which contains the great mass of our European pasture grasses. On the agricultural bearings of the question it is likely that the Department might consult with advantage Dr. Schomburgk, Baron von Mueller, Mr. Bailey, and other botanists as to what has been attempted in Australia, which species have succeeded there as forage plants, and which have been tried and failed.

J. G. B.

Prodomus of the Zoology of Victoria. By Sir Frederick McCoy, M.A., &c. Decades 18, 19, and 20. (London: Trübner and Co., 1889.)

THESE three decades complete vol. ii. of this well-illustrated natural history of Victoria. Of the thirty coloured plates in these parts, four are devoted to Reptiles, seven to Fishes, three to Mollusca, nine to Polyzoa, two to Insects, four to Crustacea, and one to Echinoderms. Among the more noteworthy species figured may be mentioned—*Cyclodus occipitalis*, very rare in Victoria; the great red king crab (*Pseudocarcinus gigas*), from life; *Sepia apama*, which, though one of the commonest species of cuttlefish, does not appear to have been figured before; *Trachinops caudimaculatus*, McCoy, a little fish which created a great sensation by appearing in large numbers, about the middle of October 1884, off the piers at Williamstown, in Hobson's Bay, and being reported to the Commissioner of Customs as the young of the Californian salmon, introduced by Sir Samuel Wilson. The publication of such figures as are to be found in these decades will not only help to prevent such mistakes in the future, but will also be a direct means of calling attention to animals important from an economic point of view. Figures of *Pyrameis itea* and of *P. kershawi*, with their larval and pupal forms, are given; this latter species is very closely related to our own "painted lady," the three lower spots on the posterior wings in the Australian form are of a bright cobalt blue in their centre, instead of black. In the latter end of October and beginning of September 1888, this butterfly appeared in extraordinary numbers for two or three weeks, almost darkening the sky with their general flight towards the south-east, covering the gear and decks of ships many miles out at sea, and filling the air on land from the northern parts of the colony down south to Melbourne. They were accompanied by a day-flying moth (*Agrotis spina*).

Annals of a Fishing Village. Drawn from the Notes of "A Son of the Marshes." Edited by J. A. Owen. (Edinburgh and London: Blackwood and Sons, 1891.)

EVERYONE who has seen much of the marshlands is aware that to a lover of Nature they have a peculiar charm of their own, and that even now, when local individuality is everywhere being so rapidly effaced, there is something characteristic in the manners and customs of the marshmen. These special qualities are well brought out in the present volume, the substance of which, according to the editor, is "from the life," although real names are not given. "A Son of the Marshes," whose notes have been worked up by Mr. Owen, has had ample opportunities of becoming familiar with every phase of Marshland; and there are in the "Annals" many passages which show that he is a keen and accurate observer.

Solutions of the Examples in Elementary Algebra. By H. S. Hall, M.A., and S. R. Knight, B.A. (London: Macmillan and Co., 1891.)

THE authors of this book seem to have taken great trouble in securing accuracy: although we have worked out many of the examples taken at hazard, no errors have been brought to light. By making a judicious use of the examples, the student will find himself materially helped, especially if he is studying the subject without the aid of a teacher. We may also recommend this key to teachers, who will find much of their time saved by having it in their possession.

British Ferns, and where Found. By E. J. Lowe, F.R.S. (London: Swan Sonnenschein, 1891.)

THIS volume belongs to the "Young Collector Series," and presents an immense mass of carefully-arranged information on the subject with which it deals. The author has been a cultivator of British ferns since 1842, so that he is thoroughly and practically familiar with them, and knows exactly what are the kinds of facts for which a collector would be likely to look in a work of this sort. The book ends with a series of useful hints to fern cultivators.

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